Docket No. AUS920010507US1

METHOD FOR IMPROVED ADMINISTERING OF TESTS USING CUSTOMIZED USER ALERTS

BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention is directed to an improved data processing system. More specifically, the present invention is directed to a method in a data processing system for improved administering of tests using customized user alerts.

2. Description of Related Art:

On-line testing is becoming more prevalent as users of data networks realize the potential to obtain training and education via electronic means. Many colleges and universities are beginning to offer classes via computer networks, such as the Internet. With such classes, a user may download a previously recorded lecture or receive a audio/video feed of a live lecture through the user's home computer system. In this way, the student need not be physically located in the lecture location to obtain the benefit of the teacher's instruction.

In addition, some educational institutions are providing students with the ability to take tests via their home computer and a data network. With such "on-line" testing, typically the student is able to download a copy of the test, take the test, and provide his/her answers to the instructor by uploading the answers to the instructor's computer system. Thus, the student takes the test under the "honor" system. That is, there is no supervision of the student's testing

environment to make sure that the student has not cheated on the test.

Furthermore, since there is no supervision of the student while taking the on-line test, the student may lose track of time. Since almost all tests in general and on-line tests in particular are timed tests, a specified amount of time is allotted to complete the test. In a supervised test taking environment, there is often a proctor which alerts the student periodically of the time that has elapsed since the start of the test as well as the time remaining to complete the test. With on-line testing this proctor is not available and, therefore, the situation may occur in which the student spends too much time on one or more questions. In such a situation, the student may, without realizing it, not be able to finish the test in the allotted amount of time. If time runs out before the student has time to complete or at least attempt to answer all the questions on the test, the student may be unduly penalized. If the student does not have time to complete the test, the student will most probably receive a failing grade and may become discouraged in attempting to further his or her educational goals.

Therefore, it would be beneficial to have an apparatus, system, and method by which a student's testing progress can be monitored from a remote location in order to make sure that the student does not spend an inordinate about of time on any one question during an examination. Moreover, it would be beneficial to have an apparatus, system, and method by which proctoring of an on-line test may be provided by a third party that is capable of proctoring the exam from a remote location and

providing time alert notification to the student during the examination in an effort to aid the student in being able to complete the exam in the allotted test taking period.

SUMMARY OF THE INVENTION

The present invention provides an apparatus, system, and method for monitoring test question response time from a remote location. More specifically, the present invention provides a mechanism by which tests may be proctored to users from a remote location as a test administration service and to provide alert notifications to the users based on the amount of time that elapsed during the test taking process as well as the amount of time remaining to take the test. With the present invention, test progress data is obtained from the user and forwarded to a proctor workstation. A proctor device may monitor the user's test progress to determine if expected progress on the test is being attained. The testing progress data may be recorded along with test input data from the user's client device for later use. Moreover, the administering of the test may be done by a third party as a test administration service to which a test developer may subscribe. Alternatively, the users of the test administration service may be billed for their individual use of the test administration service. Other features of the present invention will be described or will become apparent to those of ordinary skill in the art in view of the following detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1 is an exemplary block diagram of a network data processing system in which the present invention may be implemented;

Figure 2 is an exemplary block diagram of a server in accordance with the present invention;

Figure 3 is an exemplary block diagram of a client device in accordance with the present invention;

Figure 4 is an exemplary block diagram of the primary components of the automated test proctoring system according to the present invention;

Figure 5 is an example screen of a test proctor workstation in accordance with the present invention;

Figure 6 is an exemplary block diagram for a testing alert notification system in accordance with the present invention;

Figure 7 is an exemplary block diagram for a testing alert notification system in accordance with the present invention;

Figures 8A and **8B** are exemplary examinee profiles for alerting an examinee while taking a test in accordance with the present invention;

Figure 9 is an exemplary flowchart illustrating establishing an examinee profile to customize a test notification alert in accordance with the present invention;

Figure 10 is an exemplary flowchart illustrating a notification alert to an examinee while taking a test in accordance with the present invention; and

Figure 11 is an exemplary flowchart illustrating generating a profile database for each question of a test in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 is an exemplary diagram of a distributed data processing system in accordance with the present invention. As shown in **Figure 1**, the distributed data processing system **100** includes a plurality of client devices **108, 111** and **114** coupled to at least one network **102**. In addition, the network **102** is coupled to a test developer system **101** and a test administration system **103**. The test developer system **101** may be used to develop a test to be administered by the test administration system **103**. Client devices **108, 111**, and **114** may log onto the test administration system **103** so that users of the client devices **108, 111**, and **114** may be administered the test developed by the test developer system **101**.

The test developer system **101** and the test administration system **103** may be operated by the same or different entities. For example, the test developer system **101** may be a computer system associated with an institution interested in testing individuals. For example, the test developer system **101** may be a computer system associated with a college, university, corporation or other business entity, government agency, or the like. The test that is to be administered to the individuals may be developed using the test developer system **101** or the test developer system **101** may simply be used as a means by which the test is transferred to the test administration system **103**.

The test administration system **103** may be operated by the same or a different entity from that of the test

developer system **101**. Thus, for example, the college, university, corporation or other business entity, government agency, or the like, that operates the test developer system **101** may also operate the test administration system **103**. Alternatively, the test administration system **103** may be operated by a third party who is contracted by the operator of the test developer system **101** to administer their test.

The test administration system **103** has at least one central server **104** that is used to send and receive testing and monitoring information to and from the client devices **108, 111,** and **114** and the proctor workstations **105-107**. The proctor workstations **105-107** are used to monitor individuals taking tests administered by the test administration system **103**. The proctor workstations **105-107** receive monitoring information from the client devices **108, 111,** and **114,** and are able to perform various functions in response to a proctor device's input, as will be described in more detail hereafter.

The client devices **108, 111,** and **114** have one or more input devices **109, 110, 112, 113, 115,** and **116** which are used to monitor the testing environment of users of the client devices **108, 111,** and **114**. The particular input devices shown in **Figure 1** include digital camera devices **109, 112, 115** and audio pickup device **110, 113,** and **116**. Digital camera devices **109, 112,** and **115** may be, for example, a web camera or the like, and audio pickup devices **110, 113,** and **116** may be a microphone or the like. Other types of input devices may be used without departing from the spirit and scope of the present invention.

The digital camera devices **109**, **112**, and **115** and audio pickup devices **110**, **113**, and **116** are used to input signals to the client devices **108**, **111**, and **114** representing the visual and auditory aspects of the testing environments of the users of the client devices **108**, **111** and **114**. The input signals from the digital camera devices **109**, **112**, and **115** and audio pickup devices **110**, **113**, and **116** are input to the client devices **108**, **111** and **114** which then transmit the input signals as data packets to the test administration system **103**, and in particular server **104**. The server **104** then routes the data packets to an appropriate proctor workstation **105-107** that is assigned to monitor the particular client device, such as client device **108**, **111**, or **114**, as will be described in more detail hereafter.

As mentioned above, the distributed data processing system **100** contains the network **102**, which is the medium used to provide communications links between various devices and computers connected together within network data processing system **100**. Network **102** may include connections, such as wire, wireless communication links, or fiber optic cables. Network **102** may further be comprised of more than one network of the same or different types. Thus, for example, the network **102** may include the Internet, local area networks (LANs), wide area networks (WANs), proprietary networks, wired or wireless telecommunication networks, and the like.

The client devices **108**, **111**, and **114** may be, for example, personal computers or network computers. Client devices **108**, **111**, and **114** are clients to the central server **104** of the test administration system **103**. Network

data processing system **100** may include additional servers, clients, and other devices not shown.

In the depicted example, distributed data processing system **100** is the Internet with network **102** representing a worldwide collection of networks and gateways that use the TCP/IP suite of protocols to communicate with one another. At the heart of the Internet is a backbone of high-speed data communication lines between major nodes or host computers, consisting of thousands of commercial, government, educational and other computer systems that route data and messages. **Figure 1** is intended only as an example, and not as an architectural limitation for the present invention.

Figure 2 is an exemplary block diagram of a server in accordance with the present invention. **Figure 2** may be implemented as a server, such as central server **104** in **Figure 1**. Data processing system **200** may be a symmetric multiprocessor (SMP) system including a plurality of processors **202** and **204** connected to system bus **206**. Alternatively, a single processor system may be employed. Also connected to system bus **206** is memory controller/cache **208**, which provides an interface to local memory **209**. I/O bus bridge **210** is connected to system bus **206** and provides an interface to I/O bus **212**. Memory controller/cache **208** and I/O bus bridge **210** may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge **214** connected to I/O bus **212** provides an interface to PCI local bus **216**. A number of modems may be connected to PCI bus **216**. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors.

Communications links to network computers **108**, **111** and **114** in **Figure 1** may be provided through modem **218** and network adapter **220** connected to PCI local bus **216** through add-in boards.

Additional PCI bus bridges **222** and **224** provide interfaces for additional PCI buses **226** and **228**, from which additional modems or network adapters may be supported. In this manner, data processing system **200** allows connections to multiple network computers. A memory-mapped graphics adapter **230** and hard disk **232** may also be connected to I/O bus **212** as depicted, either directly or indirectly.

Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary. For example, other peripheral devices, such as optical disk drives and the like, also may be used in addition to or in place of the hardware depicted. The depicted example is not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in **Figure 2** may be, for example, an IBM e-Server pSeries system, a product of International Business Machines Corporation in Armonk, New York, running the Advanced Interactive Executive (AIX) operating system.

Figure 3 is an exemplary block diagram of a client device in accordance with the present invention. Data processing system **300** is an example of a client computer. Data processing system **300** employs a peripheral component interconnect (PCI) local bus architecture. Although the depicted example employs a PCI bus, other bus architectures such as Accelerated Graphics Port (AGP) and Industry Standard Architecture (ISA) may be used.

Processor **302** and main memory **304** are connected to PCI local bus **306** through PCI bridge **308**. PCI bridge **308** also may include an integrated memory controller and cache memory for processor **302**. Additional connections to PCI local bus **306** may be made through direct component interconnection or through add-in boards. In the depicted example, local area network (LAN) adapter **310**, SCSI host bus adapter **312**, and expansion bus interface **314** are connected to PCI local bus **306** by direct component connection. In contrast, audio adapter **316**, graphics adapter **318**, and audio/video adapter **319** are connected to PCI local bus **306** by add-in boards inserted into expansion slots. Expansion bus interface **314** provides a connection for a keyboard and mouse adapter **320**, modem **322**, and additional memory **324**. Small computer system interface (SCSI) host bus adapter **312** provides a connection for hard disk drive **326**, tape drive **328**, and CD-ROM drive **330**. Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

An operating system runs on processor **302** and is used to coordinate and provide control of various components within data processing system **300** in **Figure 3**. The operating system may be a commercially available operating system, such as Windows 2000, which is available from Microsoft Corporation. An object oriented programming system such as Java may run in conjunction with the operating system and provide calls to the operating system from Java programs or applications executing on data processing system **300**. "Java" is a trademark of Sun Microsystems, Inc. Instructions for the operating system, the object-oriented operating system, and applications or

programs are located on storage devices, such as hard disk drive **326**, and may be loaded into main memory **304** for execution by processor **302**.

Those of ordinary skill in the art will appreciate that the hardware in **Figure 3** may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile memory) or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in **Figure 3**. Also, the processes of the present invention may be applied to a multiprocessor data processing system.

As another example, data processing system **300** may be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not data processing system **300** comprises some type of network communication interface. As a further example, data processing system **300** may be a Personal Digital Assistant (PDA) device, which is configured with ROM and/or flash ROM in order to provide non-volatile memory for storing operating system files and/or user-generated data.

The depicted example in **Figure 3** and above-described examples are not meant to imply architectural limitations. For example, data processing system **300** also may be a notebook computer or hand held computer in addition to taking the form of a PDA. Data processing system **300** also may be a kiosk or a Web appliance.

The present invention provides a method, system and computer program product for an improved administration of tests. The improved test administration process of the present invention uses customized, dynamic user

alerts wherein the alerts are periodically presented to the user indicating the user's progress on the a test. This alert may be coupled with the presentation of one or more test questions on an electronic test station. The alert may notify the user of a suggested time to be spent on each individual test question as well as the time available to complete the test. The suggested amount of time for each test question may be calculated based on a perceived difficulty level of the test question.

Figure 4 is an exemplary block diagram of the primary components of the automated test proctoring system **400** according to the present invention. The primary operational components shown in **Figure 4** may be embodied as hardware components, software instructions, or a combination of hardware components and software instructions. In a preferred embodiment, the primary operational components are a combination of software instructions executed by a processor of the central server, such as processor **202** or **204**, and hardware components, such as modems, network interfaces, storage devices, and the like.

As shown in **Figure 4**, the primary operational components include a controller **410**, a network interface **420**, a workstation interface **430**, a session database **440**, a testing database **450**, a session timing device **460**, and a testing environment storage device **470**. These components are in communication with one another via the control/signal bus **480**. Although a bus architecture is shown in **Figure 4**, the present invention is not limited to such and any architecture that facilitates the transfer of data and control signals between the components **410-470** may be used without departing from the

spirit and scope of the present invention.

The controller **410** controls the overall operation of the central server and orchestrates the operation of the other components **420-470** by sending control messages to these components **420-470** via the control/signal bus **480**. The network interface **420** provides a communication pathway between the central server and the at least one network **102**. Data packets from client devices are received via the network interface **420** and data packet messages are sent to the client devices via this network interface **420** under instruction by the controller **410**.

The workstation interface **430** provides a communication pathway between the central server and one or more proctor workstations. Monitoring information, such as the data packets received from the client devices, is sent to an appropriate proctor workstation via the workstation interface **430**. In addition, instructions and data may be received from the proctor workstations via the workstation interface **430** for processing by the controller **410** and, in some cases, forwarding to the client devices via the network interface **420**.

The session database **440** stores information associated with a particular testing session of a particular client device. The session database **440** stores entries for each session that is currently active. When a user of a client device, for example, first logs onto the test administration system via his client device, a session id is associated with the client device. This session id is stored in the session database **440** along with any other pertinent information

needed for administration of tests to the user of the client device. Such information may include the user's name, address, student id number, test identifier, and the like.

In addition, the session database **440** includes an indicator of the proctor workstation assigned to monitor the session. The particular proctor workstation assigned is determined by the controller **410** at initiation of the session. The assignment of the proctor workstation may be performed in any reasonable manner. For example, the proctor workstation may be assigned based on relative current workloads of the various proctor workstations, a random selection, a type of test being administered during the session, or the like.

The session database **440** is also used as a means for correlating data packets received from client devices and send to client devices via the central server. Each data packet contains header information that includes the session identifier for the session to which the data packet belongs. From the session id of the data packet header, the appropriate proctor workstation or client device that is to receive the data packet may be determined. The data packet may then be routed to the proper receiving device based on this identification.

The testing database **450** stores the data representing the tests that are administered by the test administration system. The data in the testing database **450** may be used to generate tests to be administered to the various client devices. These tests may be administered in the form of applications, applets, hypertext markup language (HTML) web pages, or the like. The user of a client device may enter answers to test

questions via the particular form in a manner generally known in the art. The correct answers to the various test questions may also be stored in the testing database **450** and used as a means for scoring the answers received from the user via the client device. Once the test is completed by the user, the final score for the user may be stored in a permanent memory location for use by the test developer system and/or may be provided to the user via the client device.

In addition, the testing database **450** may store an indication of the number of users to which the particular test was administered. This information may be used by a payment system to determine an amount to bill the test developer system operator for use of the test administration service of the test administration system. The session timing device **460** is used to time each of the currently active sessions being administered by the test administering system. The session timing device **460** determines a currently elapsed time of the test session, compares the currently elapsed time to a total time length of the administered test, and determines whether the test should be ended based on the comparison. In addition, the session timing device **460** may be used to time stamp data received from the client devices as well as test answer input received from the client devices.

The testing environment storage device **470** is used to record the data of a user's testing environment during a session. The data may be recorded for the entire session or a portion of the session based on input from a proctor device of a proctor workstation. As mentioned above, the data may be time stamped in order to correlate the data later. The data may further be stored in

association with a session id for the particular session.

In operation, a user of client device may log onto the central server by entering, for example, a universal resource locator (URL) of the test administration system central server using a web browser application in a manner generally known in the art. The user may be presented with a list of tests available and may select a test to take using an input mechanism associated with the client device and a web page downloaded to the client device, for example. Once the user selects a test to be administered, a session is established and a session id is assigned. In addition, a proctor workstation is assigned to monitor the user's testing progress while the user takes the test. The session entry is stored in the session database **440**, and the test is retrieved from the testing database **450**. The test is then downloaded to the user's client device via the network interface **420**. The session timing device **460** is then initiated for the session and is used to time the test as well as provide time stamp information for answer input data received from the client device.

Input to the client device is forwarded to the central server and received by the controller **410** via the network interface **420**. The data may then be forwarded to the proctor workstation via the workstation interface **430** and may be stored in the testing environment storage device **470**. Routing of the data as well as storing of this data in the testing environment storage device **470** may be based on a comparison of the header information for the data to session information stored in the session database **440**.

A proctor device may monitor the timing data via the

proctor workstation and may be able to input instructions and messages via the proctor workstation. For example, the proctor device may input instructions to end a session, send an instant text message to the client device, and may select which sessions the proctor device wants to monitor, as will be described in greater detail hereafter. In addition, the proctor device may receive instant text messages from the user of the client device via the proctor workstation.

Once the test is completed, the user's score for the test may be permanently stored for use by the test developer system and may also be provided to the user for his/her own edification. Once the testing session terminates, the session entry in the session database **440** may be deleted.

As mentioned above, the testing database **450** may also store information pertaining to the number of users that have taken the test. This information may be used by the controller **410** to generate a bill for the test developer system operator. Thus, in this way, the test developer system operator may be billed for the actual number of users that used the test administration services of the test administration system. Alternatively, the controller **410** may generate bills for each of the users based on information received from the users during an initial registration procedure as is generally known in the art. The bills generated by the controller **410** may be provided to the bill recipients via any known manner, including regular mail, electronic mail, or other electronic transmission means.

As stated above, the present invention provides a mechanism by which a test may be administered and a

testing progress may be monitored from a remote location. In addition, the present invention provides a mechanism by which a third party may be contracted to administer tests to client devices for a fee. The present invention allows a proctor device to monitor a plurality of test takers from a single workstation. A workstation interface for performing these monitoring tasks is described herein below.

Figure 5 is an exemplary diagram illustrating a workstation interface in accordance with one exemplary embodiment of the present invention. As shown in **Figure 5**, the workstation interface **500** includes a listing **510** of currently active sessions, an instant text message box **520**, and one or more windows **530** in which test timing information for a selected test session may be displayed.

The listing **510** of currently active sessions may include one or more entries for sessions that are currently active and are assigned to this particular proctor workstation. Each entry in the listing **510** may include an examinee identification, a currently elapsed time of the testing session, and an indicator of the test being administered. Other information may be displayed in addition to or in replacement of the information explicitly shown in **Figure 5** without departing from the spirit and scope of the present invention.

The proctor device may select sessions from the listing **510** which the proctor device wishes to monitor using a test environment window **530**. Upon selection of a session, a test environment window **530** for the session is generated and the video and/or audio data being received from the client device is output to the proctor workstation.

The test environment window **530** includes a video image section **531** which displays the video information currently being received from the client device. This video information may be received, for example, as a data stream or the like. In addition, the audio data being streamed from a client device may be output using speakers or the like, for a currently selected environment window **530**.

The environment window **530** further may include virtual buttons **532-536**. These virtual buttons **532-536** may be used by a proctor to input commands to initiate functions to be performed by the controller **410**. For example, the virtual button **532** may be used to cause the controller **410** to instruct that the audio data being received not be forwarded to the proctor workstation. The virtual button **533** may be used to instruct the controller **410** to start recording of video and audio data. The virtual button **534** may be used to open a text box for sending an instant message to the user of the client device. The virtual button **535** may be used to terminate a testing session and the virtual button **536** may be used to close an environment window.

The instant message text box **520** is used to display instant messages received from a client device and instant messages sent to a client device. In this way, the proctor may review a text conversation being conducted between the proctor and the user. One instant message text box **520** may be used for all client devices and users with designations being displayed before each message or separate instant message text boxes **520** may be generated for each session.

Figure 6 is an exemplary block diagram for a testing alert notification system in accordance with the present invention. As shown in **Figure 6**, network **602**, which may, for example, be similar to network **102** in **Figure 1**, is connected to examination server **604**, alert database **616**, user/examinee **608** and user/examinee **612**. Examination server **604** contains graphical user interface **606**, which may, for example, be similar to workstation **500** in **Figure 5**. User/examinee **608** contains graphical user interface **610** and user/examinee contains graphical user interface **614**. With the use of graphical user interface **606** a proctor may, for example, monitor the time taken by a particular user to answer a question, send an instant text message to a user alerting the user of time remaining to answer a particular question, send an instant text message to a user indicating a typical time to answer a particular test question, and the like. With the use of graphical user interface, a proctor located at examination server may monitor the progress of either user/examinee **608** and/or user examinee **612** while taking the test. If the proctor located at examination server **604** determines that a user at user/examinee **608** has spent too long of a time in answering a question, the proctor may initiate periodic alert notification **630** to user/examinee **608** from examination server **604**. Furthermore, if the proctor located at examination server **604** determines that a user at user/examinee **612** has spent too long in answering a question, the proctor may initiate periodic alert notification **632** to user examinee **612** from examination server **604**.

In addition, with the use of graphical user interface **606** a proctor located at examination server **604** may issue a warning to the user if a question has not been answered in a predetermined amount of time. The warning may consist of time remaining to answer the question and/or an indication of how long it typically takes to answer the question.

User/examinee **608** and/or user/examinee **612** may answer test questions using graphical user interface **610** and graphical user interface **614**, respectively. In addition, graphical user interface **610** and graphical user interface **614** may be used to respond to a proctor located at examination server **604**.

Alert database **616** may contain information about users currently taking a test. In this example, user **618**, user **620** and user **622** are currently taking a test, which is being monitored by a proctor located at examination server **604**. Associated with each user, for example user **618**, may be data specifying time periods in which a particular question is expected to be answered. These time periods may be the same for each user currently taking the test and included in alert database **616** or these time periods may be customized for each user based on, for example, historical data regarding average times to answer a particular question, customized data for a particular user regarding an expected time to answer a particular question, and the like. Alert database **616** may retrieve data on a specific question from examination question database **624** and may transmit data for the time recently taken by a particular user for a specific question to examination question database **624**.

Also stored in examination question database **624** is examinee profile **626** and examination question profile **628**. Examinee profile **626** may contain data about a particular user, such as, for example, identification of the user, past test results, past times required for the user on a question for a particular difficulty level, and the like. Examination question profile **628** may contain data about past questions encountered by a specific user.

Figure 7 is an exemplary block diagram for a testing alert notification system at an editor in accordance with the present invention. In this example, network **602**, examination server **604**, user/examinee **608**, user/examinee **612**, alert database **616**, examination question database **624**, and examinee profile **626** are the same as shown in **Figure 6**. However, as shown in **Figure 7**, alert notification service server **704** may transmit data directly through network **602** to alert users at user/examinee **608** and user examinee **612**. Alert notification service server **704** may contain fields for a specific user which determines the nature of the alerts sent while taking the test.

For example, alert notification service server **704** may include registration **706**; in which a user registers to receive alerts, customization **708**; an alert mechanism customized for a user based on an examination profile, a test profile, past performance of the user, and the like; activation **710** and deactivation **712**; activation and deactivation turns the system on or off based on user preferences; and notification **714**; which is the act of sending an alert notification based on user's preferences (for example, notification after every question, after

every hour, after a predetermined period of time, etc.).

In addition, examination server may received input from examination timing database which may contain data as to how a specific user has performed in the past on examinations. Examination timing database may contain difficulty level data on questions previously seen by the user and associate the time taken by the user to answer these questions. With the use of examination timing database **722**, this provides additional input into examination server **604** about the estimated time required for a particular question and therefore, the time in which to notify the user as to time left to answer a specific question while taking a test administered by a proctor located as examination server **604**.

Figures 8A and **8B** are exemplary examinee profiles for alerting an examinee while taking a test in accordance with the present invention. As shown in **Figure 8A**, an examinee, such as examinee profile **626** in **Figure 6** and **Figure 7**, may include a time parameter for a particular question. Additionally, if a user is attempting to answer the particular question and time spent on the question has exceeded a predetermined threshold, a notification alert message may be transmitted to the user to notify the user that a certain amount of time remains to answer the question and a typical amount of time in which the question has been answered in the past.

In this example, user 1 **802**, user 2 **804** and user N **806** contain entries in an examinee profile. Each user **802**, **804** and **806** has predetermined time periods in which to answer each question associated with each question. For example, in the case of user 1 **802**, question 1 has

time t1 associated with question 1 question 2 has time t2 associated with question 2 and so on for each question on the test until question n is reached which may be the last question on the test. If a user, for example, user 1 **802** exceeds a predetermined time in which to answer a question a notification alert message may be displayed indicating to the user the amount of time left to answer the specific question as well as a typical time to answer the question. The time period left to answer the specific question and the typical time to answer the question may be a standard time applied to all test takers or a customized time associated with a particular user.

In **Figure 8B**, the examinee profile is shown for a question the examinee is currently working on, previous questions the examinee has attempted and answered and unattempted questions that remain in the test that have not been answered by the examinee. Current question examinee profile **808** may contain, for example, information such as the number of the question the examinee is currently attempting to answer, which in this example is Question 7; time taken so far by the examinee in attempting to answer the question, which in this example is 7 minutes and 7 seconds; the time allotted for the examinee to answer the question, which in this example is 11 minutes and 29 seconds; and when an alert will be sent to the examinee indicating to the examinee of an elapse of the allotted time for the current question, which in this example is 4 minutes and 22 seconds.

Previous question examinee profile **810** may contain information about questions on the present test that the

examinee has answered and may indicate actual time taken in answering each question along with the projected time in answering each question. The projected time in previous question examinee profile **810** for answering each question may be based on the examinee's previous performance level on questions determined to be of similar difficulty as each question in previous question examinee profile **810**.

Unattempted questions examinee profile **812** may contain information about projected times for answering each question which may also be based on the examinee s previous performance level on questions determined to be of similar difficulty as each question in unattempted question examinee profile **812**.

Figure 9 is an exemplary flowchart illustrating establishing an examinee profile to customize a test notification alert in accordance with the present invention. As shown in **Figure 9**, the operation beings by receiving a request for examinee registration (step **902**). Registration of the examinee is then received (step **904**). An input from the examinee from a previous examination performance is gathered from the examinee (step **906**). A determination is then made as to whether or not input is received from the examinee for a previous examination performance (step **908**). If input is not received from the examinee for a previous examination performance (step **908:NO**), a database is searched for the examinee's previous performance (step **910**).

Then a determination is made as to whether or not the examinee's previous performance exists in an examination performance database (step **912**). If the examinee's previous performance does not exist in the

examination performance database (step **912:NO**), a database is accessed to generate a generic profile for the examination in question (step **922**), and thereafter the operation terminates. If the examinee's previous performance does exist in the examination performance database (step **912:YES**), the operation continues to step **914** in which the examinee's grade category is determined.

Returning to step **908**, if input is received from the examinee for a previous examination performance (step **908:YES**), the examinee's grade category is determined (step **914**). The examinee's grade category may be determined by associating a difficulty level to each question the examinee has previously attempted and calculating a percentage of right answers obtained for each difficulty level. Alternatively, the examinee's grade category may be determined by averaging all previous tests taken by the examinee without regard to the difficulty level of each individual question.

A profile corresponding to the examinee's characteristics is then received (step **916**). The examinee profile may be determined in a variety of ways. For example, the examinee profile may be determined depending on a degree of difficulty of questions on the test along with an examinee's past performance rating on previous tests. For example, suppose for questions with a degree of difficulty of 2 and for questions with a degree of difficulty of 3, the examinee's performance is 70 percent on answering questions of difficulty 2 and 3, the system may map the examinee's profile to a "C" or 70 percentile student.

The examinee profile contains information which attempts to associate the examinee's question answering

capabilities with the degree of difficulty of the questions. For example, if the examinee is in a "C" or 70 percentile category, the test may be tailored to pose questions randomly selected in categories 2 to 3 out of a difficulty level represented by categories 1-5 with a category 1 question being the most difficult and a category 5 question being the easiest.

A examination alert profile is then customized for the registered examinee based on the test chosen for the examinee (step **918**). An examination alert schedule is then generated for transmission to the examinee's workstation during the actual administration of the test based on the examinee's customized alert profile (step **920**) and thereafter the operation terminates.

Figure 10 is an exemplary flowchart illustrating a notification alert to an examinee while taking a test in accordance with the present invention. As shown in **Figure 10**, the operation begins by establishing an examination registration process for an examinee (step **1002**). A location is then allocated for the examinee (step **1004**). The location represents time and place where the examinee's test is scheduled.

A determination is then made as to whether or not another examinee has requested to take an examination (step **1006**). If another examinee has requested to take an examination (step **1006:YES**), the operation returns to step **1002** in which an examination registration process is established for the examinee. If another examinee has not requested to take an examination (step **1006:NO**), a database is accessed to determine how the examinee has performed in the past (step **1008**).

A question database is accessed to determine how much time is needed for this particular examinee to answer the questions included on the examination (step **1010**). An alert profile is then created, as shown in **Figure 9**, based on the examinee's past performance and typical time to answer the examination questions (step **1012**).

A determination is then made as to whether or not the examinee has responded to all of the questions included in the examination (step **1014**).

If the examinee has responded to all of the questions included in the examination (step **1014:YES**), a confirmation is displayed indicating that all of the questions included in the examination have been answered by the examinee (step **1016**), and thereafter the operation terminates. If the examinee has not responded to all of the questions included in the examination (step **1014:NO**), a determination is then made as to whether or not the examinee has responded to the current question or moved to the next question (step **1016**). If the examinee has responded to the current question or moved to the next question (step **1016:YES**), the next question is displayed for an attempt by the examinee (step **1018**) and the operation continues to step **1014** in which a determination is made as to whether or not the examinee has responded to all of the questions on the examination.

If the examinee has not responded to the current question or moved to the next question (step **1016:NO**), a determination is made as to whether or not an alert should be sent to the examinee warning the examinee of the passage of the allotted time for answering the question (step **1020**). If a determination is made as to

not send the alert (step **1020:NO**), the operation waits for a predetermined amount of time (step **1022**) and thereafter returns to step **1016** in which the determination is made as to whether or not the examinee has responded to the current question or moved to the next question. If a determination is made as to send the alert (step **1020:YES**), a customized examinee alert is generated (step **1026**). The customized examinee alert is then transmitted to the examinee (step **1028**). There may be no need for the examinee to respond to the alert, the alert may disappear after a predetermined period of time, if the question is answered or if the examinee moves on to the next question. The time period in which the alert is displayed is customizable by the user.

Next, a determination is then made as to whether or not another alert is needed for the examinee (step **1030**). This additional alert may be a final alert or if the examinee takes additional time on a particular question, further alerts may be generated. Again, the display of additional alerts is based on the user's customization of the alert system. If another alert is not needed for the examinee (step **1030:NO**), the operation terminates. If another alert is needed for the examinee (step **1030:YES**), the operation returns to step **1026** in which a customized examinee alert is generated.

Figure 11 is an exemplary flowchart illustrating generating a profile database for each question of a test in accordance with the present invention. As shown in Figure 11, the operation begins by receiving an examination question from a test database (step **1102**). The examination question is associated with an expected

time in which to answer the examination question (step **1104**). An examinee is then selected (step **1106**). Time is measured for the selected examinee to answer the examination question based on the examinee's profile and the average time it takes to answer the question (step **1108**). Steps **1104** through **1108** use response time for previous questions of similar degree of difficulty as questions on the current examination for an examinee performance profile.

Then, a determination is then made as to whether or not another examinee is to be selected (step **1110**). If another examinee is to be selected (step **1110:YES**), the operation returns to step **1106** in which an examinee is selected. If another examinee is not selected (step **1110:NO**), then a determination is made as to whether or not another examination question is to be received (step **1112**). If another examination question is to be received (step **1112:YES**), the operation returns to step **1102** in which the examination question is received. If another examination question is not to be received (step **1112:NO**), an examination question timing profile is updated for the examination question for the particular user (step **1114**) and thereafter the operation terminates.

In addition to the above, if the embodiment is such that the client device is billed for use of the test administration service, a bill may be generated and transmitted to the client device. Moreover, a credit card account or other account type may be charged for providing the test administration service of the present invention.

If the embodiment is such that the test developer system operator is charged for use of the test administration service, information may be stored

indicating the number of users to which a particular test was administered. This information may then be used to generate a bill to be paid by the test developer system operator.

Thus, the present invention provides a mechanism by which tests can be proctored from a remote location. Moreover, the present invention provides a mechanism for providing a test administration service by a third party who may bill for use of the test administration service.

The above embodiments assume that a proctor device monitors the progress of the test takers and is the one that determines whether a test taker is falling behind in completing the test. However, the present invention is not limited to such. Rather, the test administration system of the present invention may be provided with instructions for automatically monitoring timing data received from the client devices to determine if expected progress of the test taker is being achieved.

In such an embodiment, the timing data is analyzed as it is received from the client devices to determine if changes in the progress of the test taker are of a type that expected progress is not being achieved. For example, the time that elapsed since beginning the current question may be compared to previous questions to determine if a large change in this data is experienced. Such large changes may indicate that the test taker has spent too long on a particular question or the test taker is involved in an activity that is not consistent with taking an on-line test. This activity may be that the test taker is no longer seated at the testing terminal or that the test taker has given up on answering any more questions.

If it is determined from the analysis of the timing data that too long of a time has been used in attempting to answer a particular question, an alert may be generated on the proctor workstation and a window displaying the timing data may be automatically enabled so that the proctor device is made aware of the longer than expected response time. Other modifications to the embodiments described above will become apparent to those of ordinary skill in view of the above description and are intended to be within the spirit and scope of the present invention. The examination environment may be wireless, wherein the client devices, alert generation, and the like may be performed using wireless means.

Further, the monitoring of elapsed time since an unanswered question has been presented may be performed using other elements other than a proctor device. For example, the monitoring and generating of alerts may be implemented in a program on the device on which the test is being presented. The program may be for example an applet. The alerts may take various forms, such as audio and/or visual. Audio alerts may be for example a tone or wave file. The tone or frequency of the tone may be varied based on how much time has elapsed. The visual indicator may be an icon or bar, which may change or animate depending on the amount of time that has elaspsed since an unanswered question has been presented.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions

and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media, such as a floppy disk, a hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and transmission-type media, such as digital and analog communications links, wired or wireless communications links using transmission forms, such as, for example, radio frequency and light wave transmissions. The computer readable media may take the form of coded formats that are decoded for actual use in a particular data processing system.

The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiments were chosen and described in order to best explain the principles of the invention, the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.